UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/621,686	07/16/2003	David Michael Davenport	130509	1764

6147 7590 08/03/2005

GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
PATENT DOCKET RM. BLDG. K1-4A59
NISKAYUNA, NY 12309

EXAMINER	
PHAN, DAO LINDA	
ART UNIT	**PAPER NUMBER**
3662	

DATE MAILED: 08/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/621,686	DAVENPORT ET AL.	
	Examiner	Art Unit	
	Dao L. Phan	3662	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 6/7/05.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-60 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 1-12,15-17,19-32,35-37 and 39-48 is/are allowed.

6)☒ Claim(s) 13-14,18,33-34,38,49 and 54-60 is/are rejected.

7)☒ Claim(s) 50-53 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: See Continuation Sheet.

Continuation of Attachment(s) 6). Other: English translation of WO/027706.

1. Applicant's arguments filed 6/7/05 have been fully considered but they are not persuasive.

2. Applicants argue on p. 2, lines 7-10 that "35 USC 102(e) is inapplicable...in the English language"". However, 35 USC 102(a) is applicable to Gannaway and Bombardier et al references.

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

4. Claims 13-14, 18, 33-34, 38, 49, 54-60 are rejected under 35 U.S.C. 102(a) as being anticipated by Gannaway (GB 2376585) or Bombardier et al (WO 03/027706).

Gannaway teaches a system and a method for determining a position of a moving platform including transmitting a carrier signal from one of the moving platform and a stationary platform, receiving a received signal at the other of the moving and stationary platforms, deriving a frequency shift between the carrier signal and the received signal, calculating the apparent closing velocity using the frequency shift and a frequency of the carrier signal, and estimating the position of the moving platform by monitoring the apparent closing velocity over a period of time; wherein the stationary platform comprises a transmitter coupled to a railway track, and wherein the moving platform is a locomotive. See abstract; p. 5, lines 10-19, p. 6, lines 7-10, p. 10, lines 4-13, p. 8, line 26-p. 9, line 11; fig. 2.

Bombardier et al teach a system and a method for determining a position of a moving platform including transmitting a carrier signal from one of the moving platform and a stationary platform, receiving a received signal at the other of the moving and stationary platforms, deriving a frequency shift between the carrier signal and the received signal, calculating the apparent closing velocity using the frequency shift and a frequency of the carrier signal, and estimating the position of the moving platform by monitoring the apparent closing velocity over a period of time; wherein the stationary platform comprises a transmitter coupled to a railway track, and wherein the moving platform is a locomotive. See abstract; p. 2, lines 5-14, p. 3, lines 13-15, p. 4, lines 10-21, p. 7, lines 18-26.

5. Claims 50-53 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. Claims 1-12, 15-17, 19-32, 35-37, 39-48 are allowed.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dao L. Phan whose telephone number is (571)272-6976. The examiner can normally be reached on M-F 9:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Tarcza can be reached on (571)272-6979. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

8. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DAO PHAN
PATENT EXAMINER

PTO 05-5087 International Publication No. WO 03/027706 A1

METHOD AND DEVICE FOR LOCATING VEHICLES BY MEANS OF THE DOPPER SHIFT OF MOBILE RADIO SIGNALS

Xiaogang Gu

UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. JULY 2005
TRANSLATED BY THE MCELROY TRANSLATION COMPANY

INTERNATIONAL PATENT OFFICE
WORLD ORGANIZATION FOR INTELLECTUAL PROPERTY
International patent published on
the basis of the Patent Cooperation Treaty (PCT)
INTERNATIONAL PUBLICATION NO. WO 03/027706 A1

International Patent Classification[7]:	G 01 S 11/10 5/02 B 61 L 25/00
International Filing No.:	PCT/EP02/08857
International Filing Date:	August 8, 2002
International Publication Date:	April 3, 2003
Priority Date: Country: No.:	 September 20, 2001 DE 101 47 462.8
Language of Submission:	German
Language of Publication:	German

METHOD AND DEVICE FOR LOCATING VEHICLES BY MEANS OF THE DOPPER SHIFT OF MOBILE RADIO SIGNALS

[Verfahren und Vorrichtung Zur Ortung von Fahrzeugen Mittels der Doppler-Verschiebung von Mobilfunksignalen]

Inventor; and Inventor/Applicant (only for US):	Xiaogang Gu [CN/DE]
Applicant (for all designated states except US):	Bombardier Transportation GmbH [DE/DE]
Designated States (national):	AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,

GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW

Designated States (Regional): ARIPO Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European Patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Published
- With International Search Report.

For an explanation of the two-letter codes and the other abbreviations, please refer to the explanations ("Guidance Notes on Codes and Abbreviations") at the start of each regular edition of the PCT Bulletin.

The invention concerns method and a device for locating vehicles. The invention is suitable for use in locating railroad vehicles, but is not limited to this use.

For many applications the route for vehicles is specified and determining a block segment of the route in which a vehicle is located or certain points of the route that the vehicle passes is of great importance.

The known mobile radio based location methods that measure the angle, time or time difference of the propagations of radio signals between the vehicle and mobile radio stations, achieves a precision barely under 100 m, for example, because of multipath propagation.

The existing satellite location systems, for example, GPS, do not achieve the necessary availability for many uses, because of blocking of the satellite signals, for example, in tunnels.

The task of the invention is to remedy the described disadvantages of the prior art and to propose a method and a device for locating vehicles, especially railroad vehicles, which in each case enables precise location of the vehicle while having high availability.

This task is solved by methods for locating vehicles in accordance with the traits of /2*
Claims 1, 2, 4 and 5 and by a device in accordance with the traits of Claim 7.

The vehicle whose position is to be determined on a known and/or predetermined route, is fitted with at least one mobile radio apparatus which can send and/or receive radio signals to and/or from mobile radio stations.

The antennae of the mobile radio stations are situated along the route and can send and/or receive the radio signals to and/or from vehicles with the mobile radio apparatus. The Doppler frequency of the radio signal is measured at the vehicle and/or the mobile radio stations.

The passage of the vehicle past the points on the route at which the line connecting the antenna of the radio-linked mobile radio station is perpendicular to the line of the route is determined by evaluating the Doppler frequency change around the point of the null Doppler frequency.

At least two mobile radio stations, at which the measured Doppler frequencies to the vehicle or to which the measured Doppler frequencies at the vehicle have different signs, are evaluated in order to detect the segment in which the vehicle is located. The segment in which the vehicle the located is determined by the route between these mobile radio stations.

The invention can, but does not have to, be based on a mobile radio system in order to detect block segments.

When used in the railroad field it is additionally advantageous for the track-side /3
GSM-R antennae to be situated within 5 m perpendicular to the rails, so that the change of the Doppler frequency between the vehicle fitted with the radio apparatus and the track-side antennae is very strong in the region of the antennae. The invention utilizes this property for location, so that it is possible to identify points near the antennae by measuring the Doppler frequency changes or recognize the route segments by measuring the Doppler frequencies with two mobile radio stations at which the Doppler frequencies have different signs.

Within a route segment the traversed path can be determined by an additional sensor like an odometer or via the integrated Doppler frequency.

Compared to the known mobile radio based location methods, the method in accordance with the invention has higher precision in location, especially at the boundaries of route segments and has a more reliable block segment recognition. The method in accordance with the invention is insensitive to multipath propagation. Time synchronization errors can easily be determined by standard measurement without additional sensors.

---

* [Numbers in the right margin indicate the pagination of the original foreign text.]

Compared to satellite location, the invention can offer better locating availability, for example, through GSM-R. Another advantage lies in the fact that no additional infrastructure is necessary if an existing network, for example, GSM-R, is used.

The invention is illustrated in more detail below by means of the embodiment examples /4
shown in the drawing. The figures are schematic and not to scale.

Figure 1 shows a vehicle route with devices for location of a railroad vehicle moving on the route and

Figure 2 shows a route with devices for locating the route segment in which a railroad vehicle is situated.

Figure 1 shows the principle of location in a representation of a route with devices for location of a railroad vehicle moving along the route. A railroad vehicle 1 with a mobile radio apparatus 2 moves from position A to position B and a mobile radio station 3 is in the vicinity of the route, in this case the track. The received mobile radio frequency at vehicle 1 or at mobile radio station 3 changes with respect to the sender frequency because of the Doppler effect. Theoretically, this frequency change caused by the relative speed between sender and receiver, the so-called Doppler frequency f, is null at position O, since the relative speed between sender and receiver at point s = O vanishes. The Doppler frequency f in front of position O (for example, s = A – O) and after position O (for example, s = O – B) has different signs if the vehicle 1 is moving. By measuring the Doppler frequency f the passage of the vehicle 1 at position O can be recognized and the route segments separated by position O can be differentiated by means of the sign change of Doppler frequency f.

If this determination of position is to be done in vehicle 1, the mobile radio apparatus 2 /5
accordingly must have at least one receiver and the mobile radio station 3 must have at least one sender. The signal transmitted by the sender of mobile radio station 3 at a specific frequency is received by the receiver of mobile radio apparatus 2. Here the transmitted GSM signal contains a user identification or a base station identification, which is also sent at the same time. The change of frequency of the received signal is detected and evaluated.

The GSM system uses an uplink and downlink frequency block. Each of these frequency blocks consists of 125 frequency channels. At the moment at which the sender and the receiver can communicate with each other, the frequency channel or the carrier frequency of the receiver is known.

Preferably, the difference to the sender frequency caused by the Doppler effect or the nominal carrier frequency of the signal which is known for the sender and the receiver, is determined and a sign change of this difference frequency is detected and interpreted as the location of vehicle 1 at position O of the route perpendicular to mobile radio station 3.

If this determination of position is to be carried out outside of the vehicle 1 whose location is to be determined, in particular in the mobile radio station 3, the radio mobile apparatus 2 must accordingly have at least one sender and the mobile radio station 3 must have at least one receiver. The signal sent by the sender of the mobile radio apparatus 2 in a specific frequency is received by the receiver of the mobile radio station 3. The change of frequency of /6
the received signal is detected and evaluated. Preferably, the difference from the nominal transmission signal caused by the Doppler effect is determined and a sign change of this different frequency is detected and interpreted as locating vehicle 1 in position O of the route vertical to mobile radio station 3. Figure 1 additionally shows a schematic f-s diagram, where position O was defined by $s = 0$.

Ambiguities may arise if there is just one mobile radio station, for example, if the direction of the travel and the location in which the vehicle is located are not known or if the vehicle stops within a segment and then travels in the reverse direction. These ambiguities can be avoided with two mobile radio stations, at which or to which the measured Doppler frequencies at the vehicle have different signs. The route can, as Figure 2 shows, have route segments K and K+1 that are separated by null Doppler frequency points, for example, three positions i-1, i and i+1 lying along the route. The first mobile radio station 4 assigned to the first position i-1 and the second mobile radio station 5 assigned to the second position i delimit the first route segment K. The second route segment K+1, which is adjacent in this example, is delimited by the second mobile radio station 5 and the third mobile radio station 6 which is assigned to the third position i+1.

If a vehicle 7 with a mobile radio apparatus 8 on it travels in the given direction, passage /7
of the vehicle 7 at the null Doppler frequency points of positions i-1, i and i+1 and the location segments K and K+1 can be determined by the evaluation of the Doppler frequency f that was described above.

In Figure 2 the first location segment K is identifiable by the mobile radio station at positions i=1 and i that give rise to different signs of the Doppler frequencies f. Thus, as shown in Figure 2, the vehicle 7 is situated in the first location segment K.

If the determination of the position is to be carried out within vehicle 7 whose location is to be determined, the mobile radio apparatus 8 accordingly must have at least one receiver and the mobile radio stations 4, 5 and 6 must each have at least one sender. The signal transmitted by the senders of the mobile radio stations 4, 5 and 6 in a specific frequency is received by the sensor of the mobile radio apparatus 8.

The receiver can in this case distinguish the sender signals by their frequencies. The frequency channels serve for this. However, there are also other possibilities for distinguishing the sender signals, such as time division multiplex access (TDMA) and code division multiplex

access (CDMA). The GSM standard uses various frequencies and time slots. On the other hand, UMTS gives priority to the use of CDMA. In CDMA different codes belonging to different senders can be based on one frequency.

The frequency shifts caused by the Doppler effect are measured in mobile radio apparatus 8 and the signs of these frequency shifts are compared with each other. If the signs of the /8
frequency shifts of two mobile radio stations 4 and 5 that form one route segment K are different, it is concluded that the vehicle 7 is located within this route segment K. If the signs of the frequency shifts of two mobile radio stations 5 and 6 that form a route segment K+1 are the same, it is possible to conclude that the vehicle 7 is situated outside of this route segment K+1.

If the determination of position is to be done outside of the vehicle 7 whose location is to be determined, for example, at a higher central authority, the mobile radio apparatus 8 accordingly must have at least one sender and the mobile radio stations 4, 5 and 6 each must have one receiver. The signal transmitted by the sender of mobile radio apparatus 8 in a specific frequency is received by the receivers of the mobile radio stations 4, 5 and 6. The frequency shifts caused by the Doppler effect are measured in each of the mobile radio stations 4, 5 and 6 and the signs of the frequency shifts are compared with each other. Different signs of the frequency shifts of two mobile radio stations 4 and 5 forming one route segment K indicate that the vehicle 7 is situated outside of this route segment K. Like signs of the frequency shifts of two mobile radio stations 5 and 6 that form a route segment K+1 indicate that the vehicle 7 is situated outside of this route segment K+1.

Advantageously, the mobile radio stations 4, 5 and 6 are situated in the vicinity of the route, since in this way the precision of the location method is increased. If the method is /9
used in particular in the railroad field, it is additionally advantageous for the track-side GSM-R antennae to be within 5 m across from the track, so that the change of the Doppler frequency f between the vehicle 1 or 7 fitted with mobile radio apparatus 2 or 8 and the track-side antennae of mobile radio stations 4, 5 and 6 is very strong in the vicinity of the antennae.

The senders or the receivers can send or receiver, for example, continuously or at intervals. In addition, it is possible to limit the transmission range of the sender and/or the effective range of the receiver in order to reduce nuisance signals.

Claims /10

1. A method for locating vehicles, especially railroad vehicles, which is characterized by the fact that

- a signal in at least one specific frequency is transmitted from at least one sender to at least one mobile radio station (3) outside of a vehicle (1) that is to be located and lying along the route of the vehicle (1),

- the signal transmitted by the sender is received by the receiver of a mobile radio apparatus (2) within the vehicle (1) that is to be located, and

- the change of frequency of the received signal is detected and evaluated.

2. A method for locating vehicles, especially railroad vehicles, which is characterized by the fact that

- a signal is transmitted in at least one specific frequency from a sender of a mobile radio apparatus (2) within a vehicle (1) that is to be located,

- the signal transmitted by the sender is received by at least receiver of at least one mobile radio apparatus (3) outside of the vehicle (1) that is to be located and

- the change of frequency of the received signal is detected and evaluated.

3. A method as in Claim 1 or 2, which is characterized by the fact that the frequency /11
shifted in comparison with the carrier frequency of the signal, which is caused by the Doppler effect (Doppler frequency) is measured, the change of the shift of the Doppler frequency is evaluated, in particular a change of sign of this Doppler frequency shift is detected, and is interpreted as the position of the vehicle (1) at a position (O) of a route perpendicular to mobile radio station (3).

4. A method for locating vehicles, especially railroad vehicles, which is characterized by the fact that

- the senders of at least two mobile radio stations (4, 5, 6) outside of a vehicle (7) that is to be located each send at least one signal with specific frequencies,

- at least one receiver of at least one mobile radio apparatus (8) within the vehicle (7) receives the signals transmitted by the senders of the mobile radio stations (4, 5, 6) and

- the Doppler frequency shifts are measured with respect to the carrier frequencies of the sent signals and the signs of the Doppler frequency shifts are compared with each other.

5. A method for locating vehicles, especially railroad vehicles, which is characterized by the fact that

- at least one sender of a mobile radio apparatus (8) within a vehicle (7) that is to be located sends a signal with at least one specific frequency,

- the receivers of at least two mobile radio stations (4, 5, 6) outside of the vehicle (7) /12
receives the signal transmitted by the sender of the mobile radio apparatus (8), and

- the Doppler frequency shifts are measured with respect to the carrier frequency of the sent signals and the signs of the Doppler frequency shifts are compared with each other.

6. A method as in Claim 4 or 5, which is characterized by the fact that from the different signs of the Doppler frequency shifts of two mobile radio stations (4, 5) forming a route segment (K), it is concluded that the vehicle (7) is located within this route segment (K) and/or from the

like signs of the Doppler frequency shifts of two mobile radio stations (5, 6) forming a route segment (K+1), it is concluded that the vehicle (7) is outside of this route segment (K+1).

7. A device for locating vehicles, especially railroad vehicles, in particular for conducting a method as in one of the preceding claims, which is characterized by

- at least one sender within and/or outside of a vehicle to be located (1, 7), where the sender sends a signal with at least one specific frequency,

- at least one receiver outside of and/or inside the vehicle (1, 7), where the receiver receives the signal of the sender,

- at least one evaluator circuit that is linked to the receiver, where the evaluator circuit measures and evaluates the change of the Doppler frequency shift and/or the Doppler frequency shifts. /13

8. A device as in Claim 7, which is characterized by the fact that the minimum of one sender and/or receiver situated outside of the vehicle that is to be located (1, 7) is situated in the vicinity of the route of the vehicle (1, 7), preferably a maximum of 5 m from the route.

9. A device as in Claim 7 or 8, which is characterized by the fact that the evaluation circuit contains means that measure the Doppler frequency shifts, detects a change of sign of these Doppler frequency shifts, and interprets it as the location of the vehicle (1) at a position (O) of a route perpendicular to the sender and/or receiver located outside of the vehicle to be located (1).

10. A device as in one of Claims 7-9, which is characterized by the fact that the evaluator circuit contains means that, from different signs of the Doppler frequency shifts of two mobile radio stations (4, 5) forming a route segment (K), concludes that the vehicle (7) is within this route segment (K) and/or from like signs of the Doppler frequency shifts of two mobile radio stations (5, 6) forming a route segment (K+1), concludes that the vehicle (7) is located outside of this route segment (K+1). /14

11. A device as in one of Claims 7-10, which is characterized by the fact that the sender and/or receiver are a part of a GSM-R network.

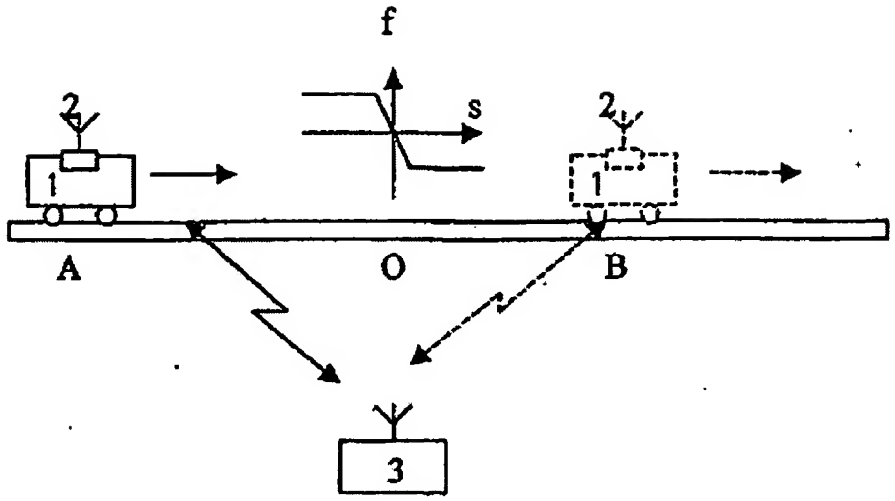

Fig. 1

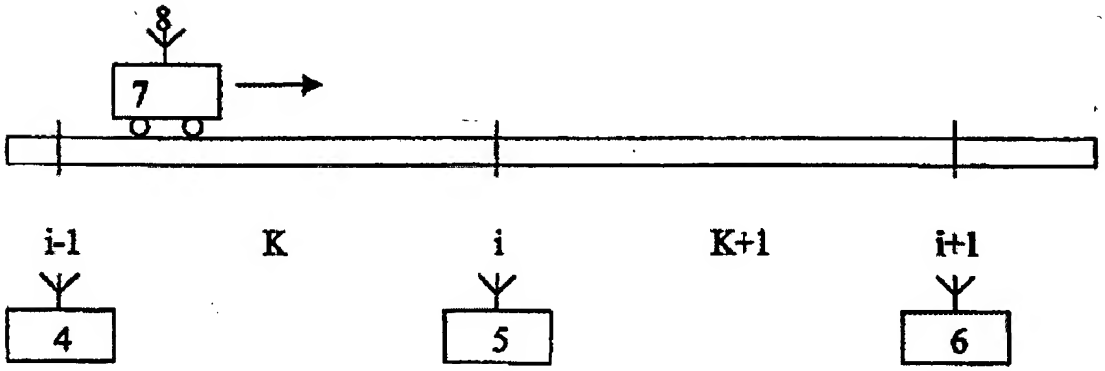

Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/08857

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01S11/10 G01S5/02 B61L25/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01S B61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 226 731 A (MARCONI CO LTD) 4 July 1990 (1990-07-04) abstract; figure 1 page 1, paragraph 5 page 2, line 3,4 page 2, line 14,15 page 3, line 3 page 5, line 12-14 page 5, paragraph 2	1-11
X	US 5 515 062 A (ATTWOOD STANLEY W ET AL) 7 May 1996 (1996-05-07) column 2, line 62 -column 3, line 10	1,2
A	GB 2 170 672 A (POLYTECHNIC ELECTRONIC PUBLIC) 6 August 1986 (1986-08-06) abstract	3,9

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 November 2002	02/12/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Grübl, A

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 02/08857

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 2226731	A	04-07-1990	NONE	
US 5515062	A	07-05-1996	NONE	
GB 2170672	A	06-08-1986	NONE	